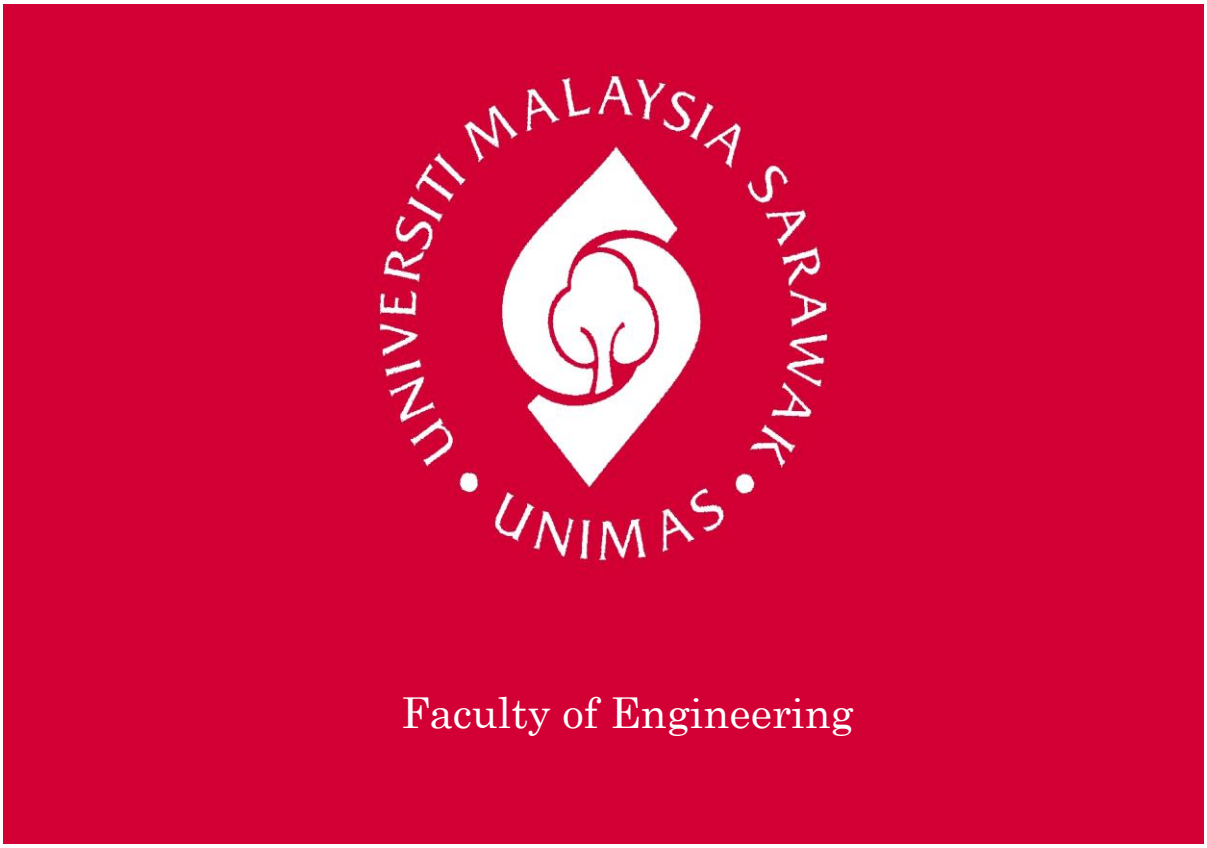

THERMAL COMFORT IN LOW COST HOUSING AT BANDAR BARU SAMARIANG

MOHAMAD KHAIRUN BIN ISHAK

Bachelor of Engineering with Honours
(Civil Engineering)
2009

UNIVERSITI MALAYSIA SARAWAK
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THERMAL COMFORT IN LOW COST HOUSING AT BANDAR BARU SAMARIANG, SARAWAK

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This thesis is submitted in partial fulfillment of the requirements for Degree of Bachelor of Engineering with Honors (Civil Engineering)

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UNIVERSITI MALAYSIA SARAWAK
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Dedicated to my beloved family

Thanks for everything

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IBS	Industrialized Building System
PMV	Predicted Mean Vote
PPD	Predicted Percentage Dissatisfied

ABSTRAK

Kerajaan Malaysia telah mengambil inisiatif untuk menyediakan perumahan kos rendah bagi menampung jumlah rakyat yang semakin bertambah di kawasan bandar untuk mereka yang mempunyai pendapatan rendah. Disebabkan permintaan yang tinggi terhadap rumah kos rendah, pengusaha perumahan telah mengambil kesempatan. Rekaan arkitek untuk rumah kos rendah ini kurang mengambil kira suasana dalam dan sekitar luar yang menyebabkan ketidakselesaan wujud di dalam rumah berkenaan. Situasi itu menyebabkan penghuni mengambil keputusan mengubah bentuk rumah mereka memenuhi keselesaan terma yang diperlukan. Dalam kajian ini, tiga buah rumah yang berlainan orientasi di Bandar Baru Samariang dipilih. Beberapa eksperimen dijalankan bagi mengkaji keselesaan terma di dalam rumah. Data kemudianya dianalisa menggunakan *"Predict Mean Vote (PMV) dan Predicted Percentages of Dissatisfied (PPD)"*. Dari analisa, mendapati bahawa rumah yang diubahsuai masih juga tidak dapat mencapai keselesaan terma yang diingini. Untuk memastikan rekaan rumah yang sesuai untuk mencapai keslesaan terma tanpa menggunakan tenaga, beberapa cadangan telah dikemukakan seperti membina siling asbestos, menggunakan tingkap *"casement"* dan membina bumbung yang lebar untuk melindungi dinding yang terdedah dengan radiasi matahari.

ABSTRACT

Malaysian Government takes an initiative to provide low-cost housing areas to accommodate the rapid growth population in the urban area for the low-income people. Due to the high demand of the low-cost house, the developers start taking advantages. The architecture design of the low-cost houses was lack of consideration of indoor climate and environment of the house which resulting the discomfort environment inside the house. Therefore the occupant of the house take action by renovated their house to adapt with the condition to fulfill their needed thermal comfort. For this study, three low-cost houses were selected with different building orientation at Bandar Baru Samariang. Several experimental works were conducted to study thermal comfort inside the house. Then data were analyzed using Predict Mean Vote (PMV) and Predicted Percentage of Dissatisfied (PPD). From the data analysis, it indicated that the renovated houses did not achieve thermal comfort required. To ensure the suitable design of the house several suggestions has been stated such as build asbestos ceiling, using casement window and build overhang roof to shade the wall that exposed to sun radiation.

CHAPTER 1

INTRODUCTION

1.0 Introduction

Malaysia is undergone a rapid growth in the urban area causing a housing shortage. Thus Malaysia is facing a similar problem with others country that to meet demand of urban populace particularly for low-income people. Thus in third till seventh Malaysian plan, the government always emphasize on building more low-cost houses to meet the demand.

According to the Seventh Malaysian's Plan (1996-2000), public and private sector has completed 190,597 units of low-income house but decreased by 27% from sixth Malaysian Plan that accumulated 261,386 units. The major problem is that the downturn

of Malaysia economic in 1997 but the number of construction show there are still lots of demand in this house category.

Due to high demand in low-cost houses, the developers have take advantages toward the buyers. The architecture design of the low-cost houses was lack of consideration of indoor climate and environment of the house. Problem with low-cost house buyers, they did not have the knowledge in environmental study in housing design. The only aspects that the buyers consider are the affordable prices of the house and the compound area of the house.

The consequences the discomfort environment would be noticeable after the buyer has occupied the houses. Therefore the occupant of house has renovated their house as their solution to achieve their own suitable thermal comfort. This is what happens in the low-cost houses area in Bandar Baru Samariang, almost every house in the area has undergone renovation.

Bandar Baru Samariang is one of the low-cost housing which had been developed by the government during the seventh Malaysia plan which applied Industrialized Building System (IBS) construction method. Unlike the conventional construction method, this method is using prefabricated component. The manufacturing of the components is systematically done using machine, formworks and other forms of

mechanical equipment. After the components are completed manufacture at offsite, it will be delivered to construction sites for assembly and erection. This development is one of an example of IBS construction method which shows modern and very systematic in construction application. (Abd. Rahman, 2006)

This Industrialized Building System was not new in Malaysia. Actually, Industrialized Building System was introduced in Malaysia as early as in 1960's but only 1998 the government make an effort as leader to persuade the construction industry in Malaysia to engaged IBS. Incooperate with Construction Industry Development Board (CIDB), Industrialized Building System (IBS) Roadmap 2003-2010 is published to give the guide and outline on several strategies and steps to promote the use of IBS in Malaysia. The advantages of IBS are to reduce the use of foreign labours, to give new level of the construction industry and show the new image of professionalism in the industry.

Eventually the IBS construction method is often related with negative meaning as it is always linked with industrialized buildings that were built in 1960s. These buildings are normally associated with prefabricated mass construction method, low quality buildings, leakages, abandoned projects, unpleasant architectural appearances and other drawbacks. Abd Rahman (2006) stated the reason for the failure is because of the lack of knowledge and exposure to IBS technology. Examples of the building with the problem are Pekeliling Flats, Kuala Lumpur and Taman Tun Sardon, Gelugor, Penang.

This same housing design is also similar to the low cost housing in Bandar Baru Samariang that was built in 1998. The house was build with simple prefabricate materials and steel frames build and roof trusses. The architecture design of the building are simple but lack consideration of the thermal comfort for occupant especially in tropical climate in Malaysia.

For example the roof of the house is built without any ceiling and radiant barrier that can prevent heat transmition from the zinc roof into space inside house. Radiant barrier can be a layer of aluminum foil placed in airspace to block radiant heat transfer from the roof and ceiling. Lack of this insulation material, result the temperature in the house increased significantly during day time. Another example is that, there is no appropriate ventilation system in the house causing the hot air trap inside the house and no air circulations happen. This house also was built without significant wall protection from sun radiation. In addition lightweight concrete is very thin and can easily transmit the heat inside the house.

Study done by Ibrahim (2004) based on thermal comfort inside the low-cost housing with no occupant in Bandar Baru Samariang indicate that the low-cost house in Bandar Baru Samariang is thermally discomfort. This thermal comfort study is done based on four factors; air temperature, air velocity, humidity and mean radiant temperature using Corrective Effective Temperature index on a basic design of house

before renovation. From this study, it is very much reflecting to the changes happen after 5 years of study. As mentioned before, most of the house in the area has been renovated to suit their thermal comfort.

As Nicol, (2003) said '*in the 21st century people can decide with the flick of a switch what the indoor temperature will be. It is easier, after all, to use a little fossil fuel to run the air conditions than to bother with the complexities of harnessing the fickle wind and the burning sun!'* With this statement it show that air conditioning system is more likely to be the choice of people today to change the condition of their environment space but it cost some energy and expensive.

In the study area of low-cost housing area of Bandar Baru Samariang, most of the occupants are low-income earners. On the first view is that air conditioning system is not an option to them because it could affect their cost of living. The results that have been expected come out differently, after 5 years there are lot changes happen. As mentioned above the low cost houses in the area are renovated, and an air condition is also a choice to several of the occupants to their comfort. One of the factors is the increases of status of living from low-income group to the range of low-medium income group of the occupants.

Some study by Nicol (2003) stated that people tend to adapt with their environment after certain period of time, climate and building services. But other factor also contributes, such as economical factor. In the study area, low-income people tend to adapt with the environmental temperature due to this economical constraint. Thus this factor contributes to thermal comfort level which will affect the surrounding accepted by them. Adaptive principle stated that '*If a change occurs such as to produce discomfort, people react in ways which tend to restore their comfort'* (Nicol, 2003). In this study, the study that will be focus is the renovation area which will evaluated on the thermal comfort level.

In terms of energy consumption, there is the different between houses that using air conditioning unit to house that only applied the thermal comfort concept to their home to achieve the same result. It is possible to design a house which fulfill thermal comfort requirement without air conditioning system and even can stay cool throughout the year. (Mohd Peter Davis, 1993).

In the Kyoto agreement, there is an international imperative to reduce energy consumption and its associated anthropogenic emissions which contribute to pollution and global climate change. Nicol, (2003) also state that *'if it is in your power to decide the indoor climate of a building, then you have to know exactly what it should be'*. Thus in this study the result of thermal comfort of renovated low-cost house can be indicate

the possible improvement of thermal comfort and can be compare to the original design house of low-cost housing.

1.1 Aim of the study

The aim of study is to compare the thermal comfort inside original design of low-cost houses with renovated low-cost houses after ten years has been occupied. In order to accomplish this aim of study, several objectives had been identified as stated below.

1.2 Objectives of the study

1. To study the thermal comfort inside original design house and renovated house
2. To compare the thermal comfort inside existing design house and renovated house
3. To determine the design parameters which contribute to effect of thermal comfort level inside the original design of the house and renovated of the house.
4. To suggest the type of design of house to improved the thermal comfort inside the house.